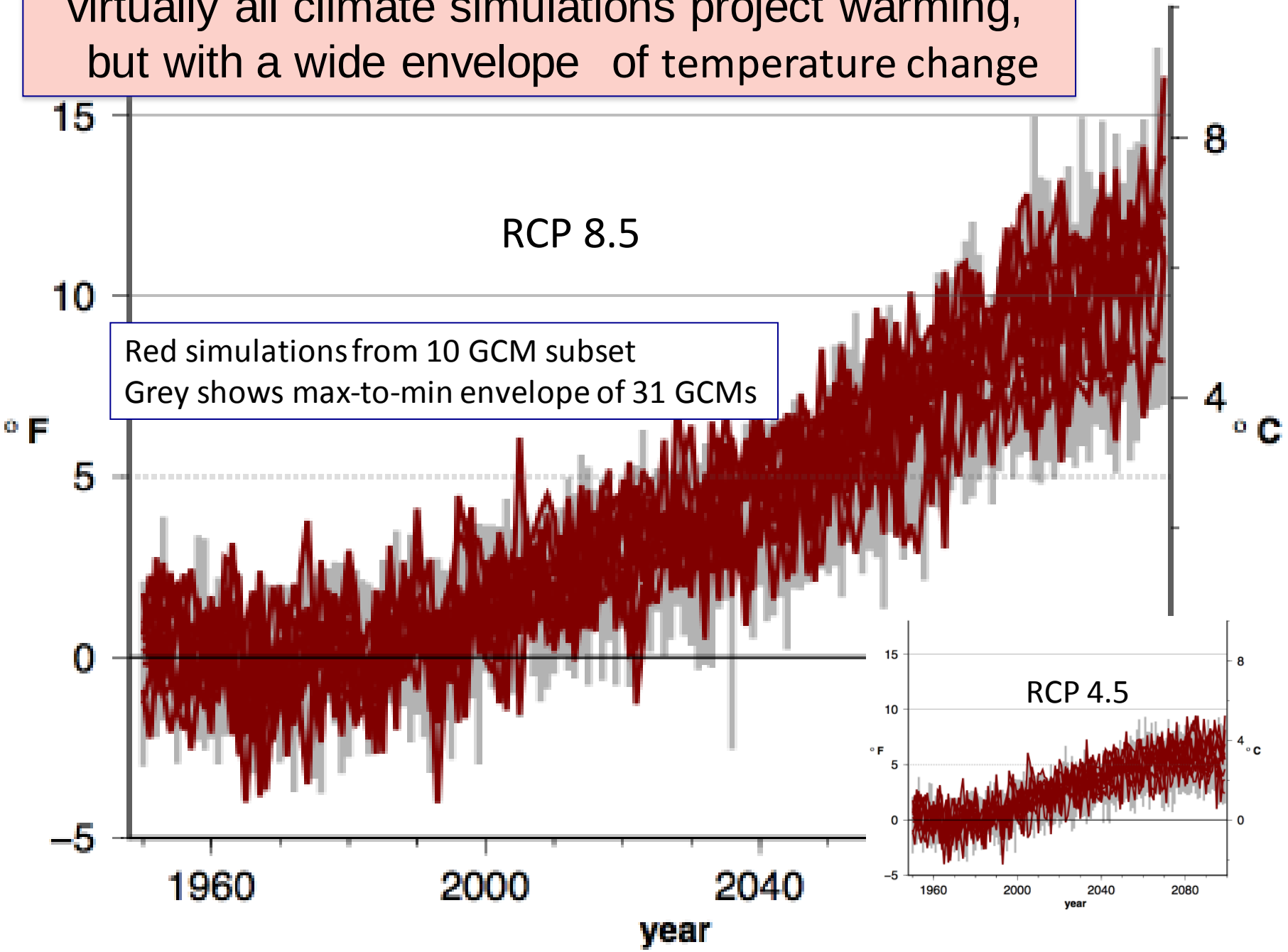
Multiple Model Climate Scenarios

California 4th Climate Change Assessment

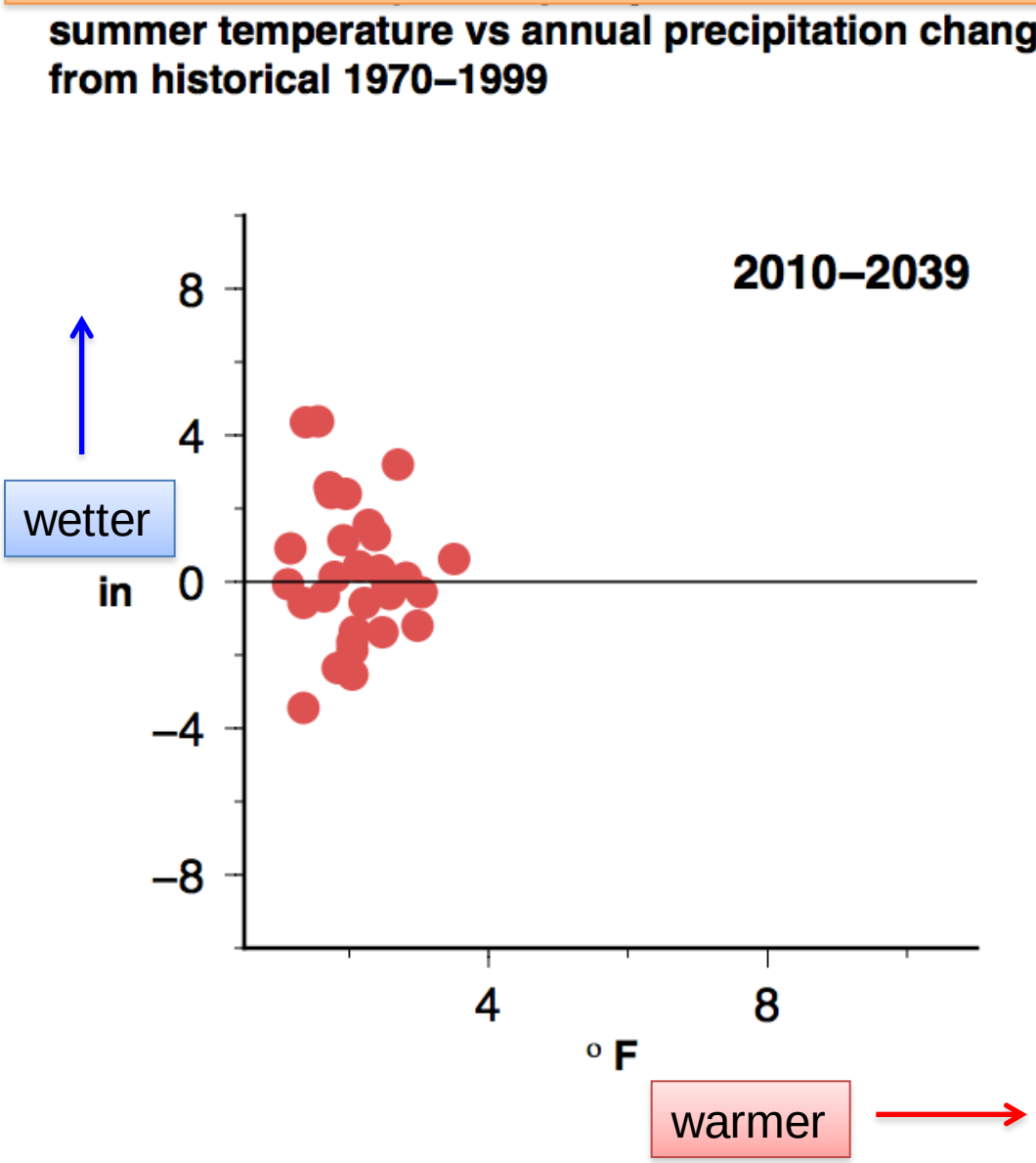
Dan Cayan SIO and USGS
Mary Tyree SIO

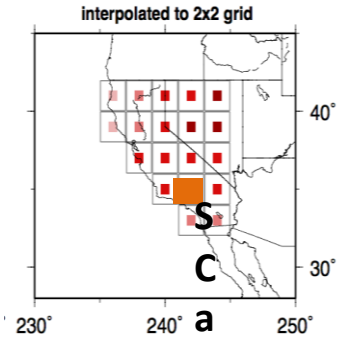
virtually all climate simulations project warming,
but with a wide envelope of temperature change



Projected change temperature and precipitation

31 Global Climate Models RCP 8.5 Los Angeles region





a warmer future
but uncertain
changes in precipitation

Projected change temperature and precipitation

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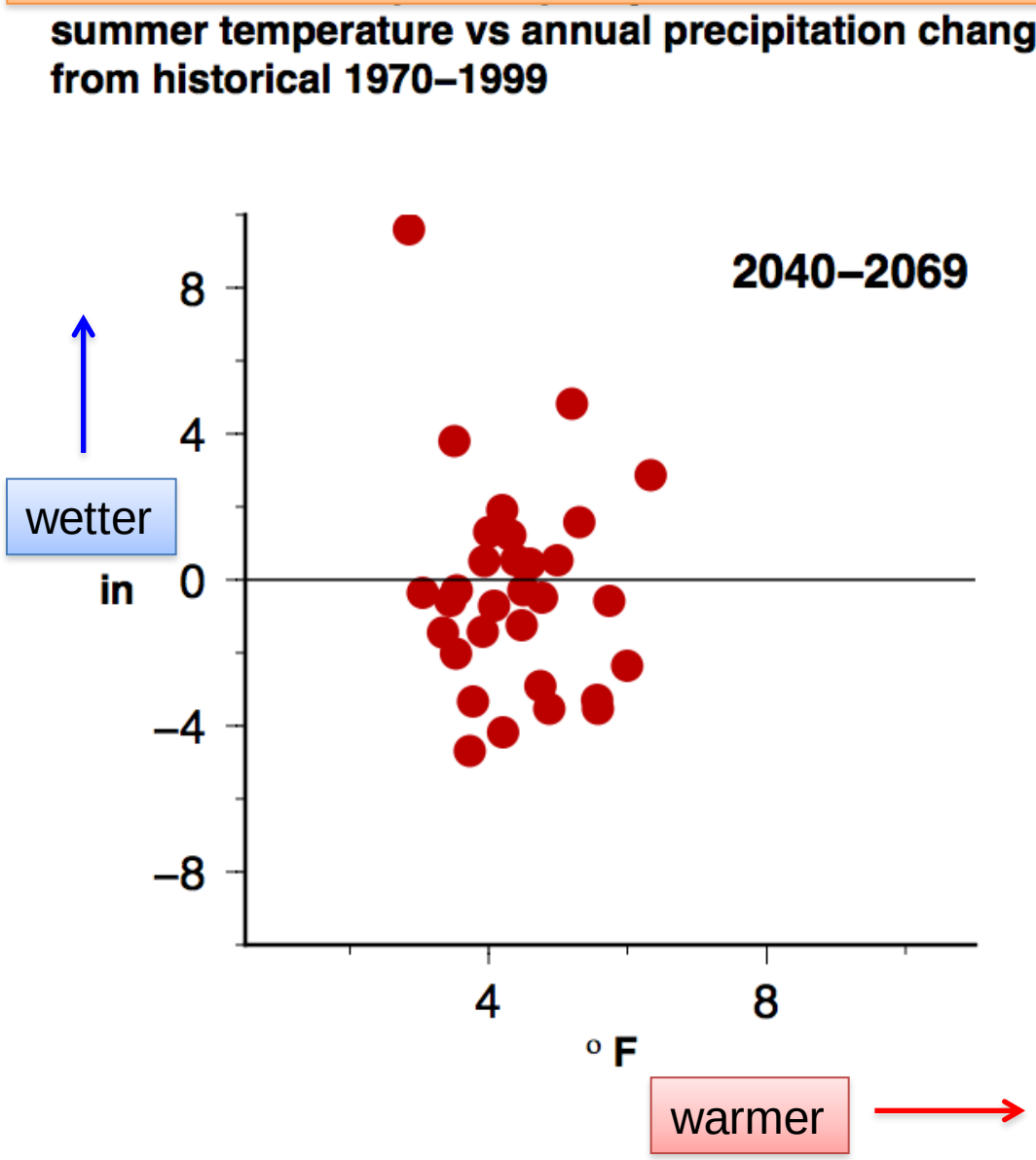

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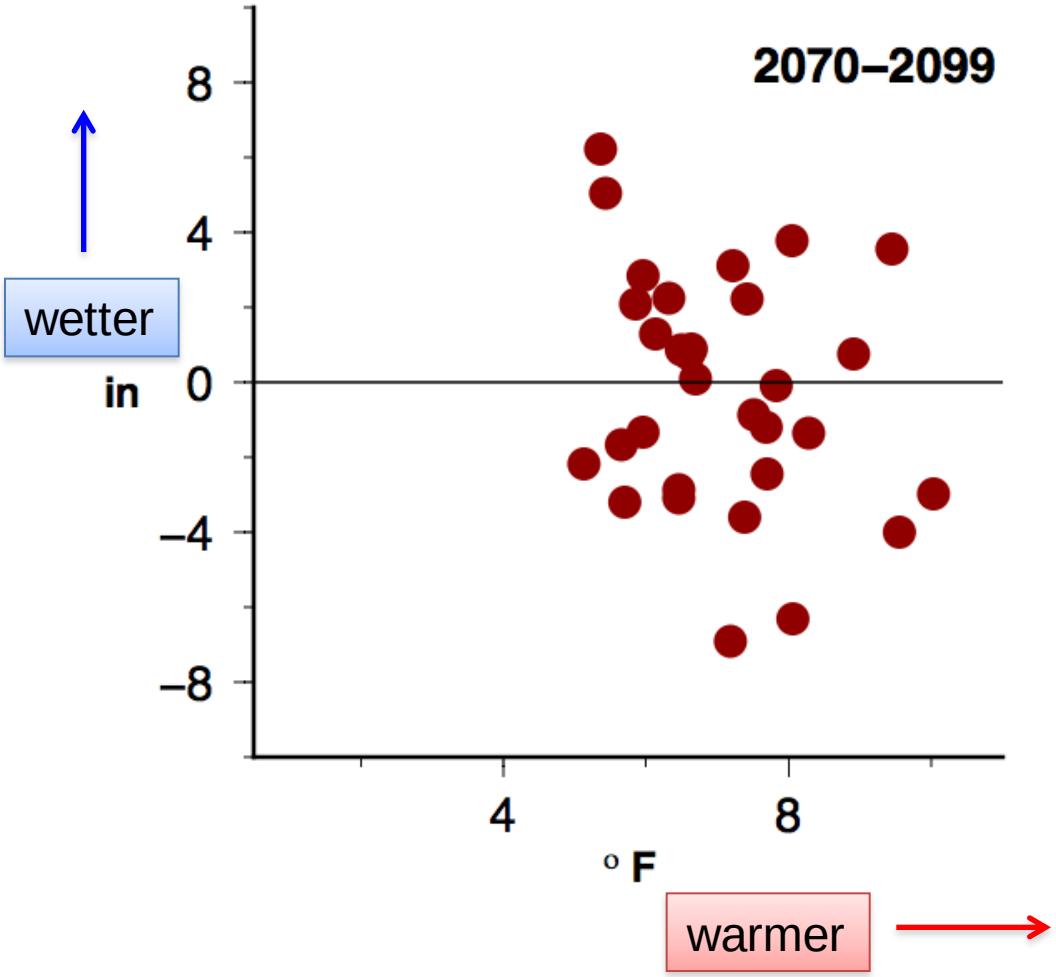
summer temperature vs annual precipitation change from historical 1970–1999



a warmer future
but uncertain
changes in precipitation

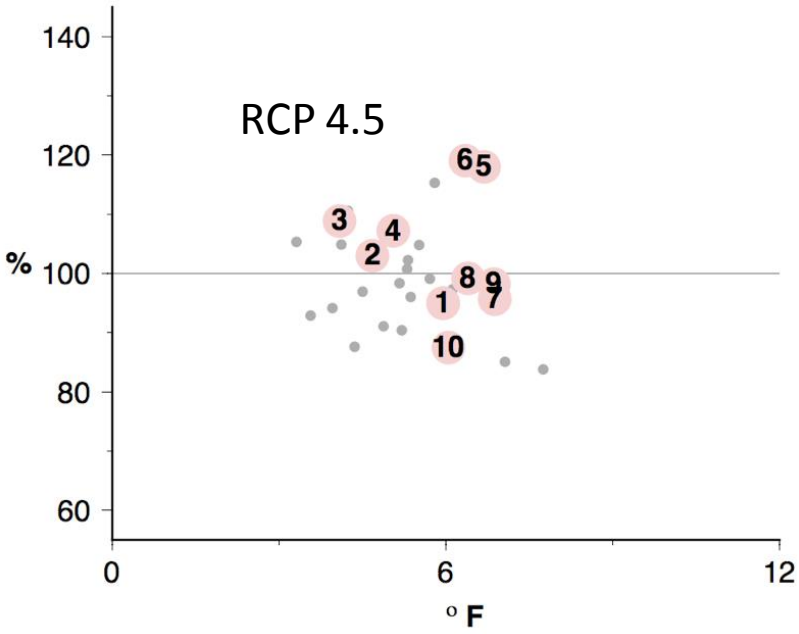
A subset of 10 GCMs provides a reasonable sample of the range of warming and precipitation change of the larger 31 member ensemble.

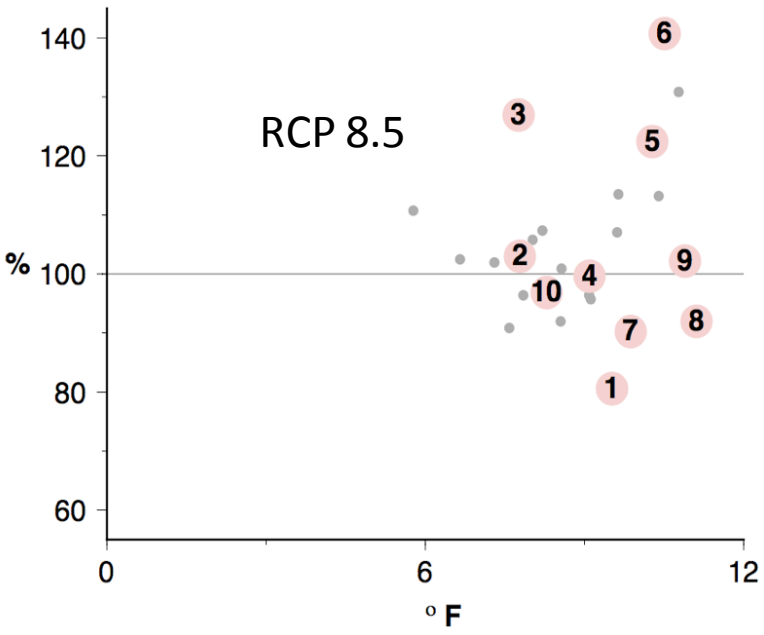
Sacramento annual temperature and annual precipitation changes

(2070-2099 vs. 1961-1990)

31 GCMs, along with a 10 selected subset

after mid-21st Century Emissions Scenario (RCP) begins to exhibit a strong effect





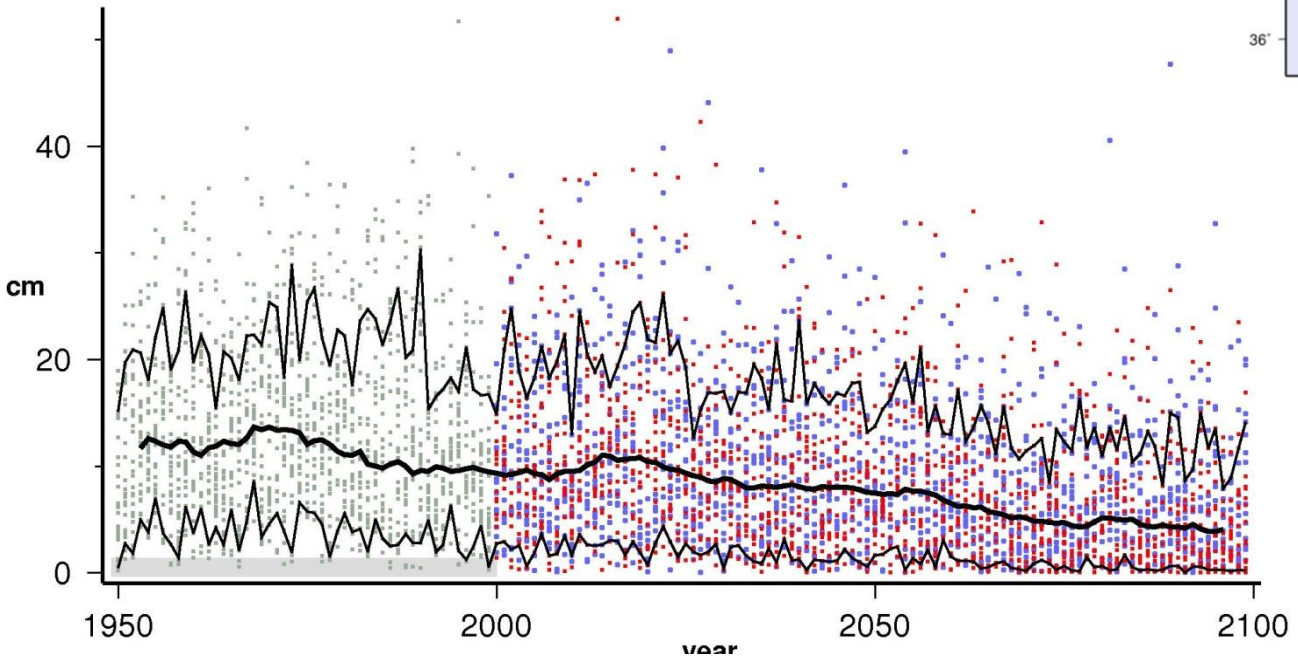
regional snow and hydrology— a sensitive index of climate variation and change

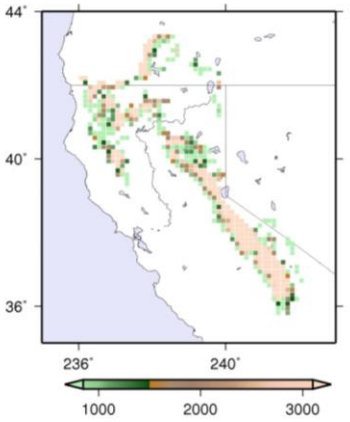
Douglas Alden
Scripps Institution of Oceanography
Installing met station
Lee Vining, CA

projected reduction in California's spring snow pack under a warmer climate

VIC model estimates indicate ~25% loss per C°

Sierra Nevada Spring Snow Water Equivalent





declining Apr 1 SWE:
2050 median SWE ~ 2/3 historical median
2100 median SWE ~ 1/3 historical median

warming-reduction of snow pack will add to water management challenges.

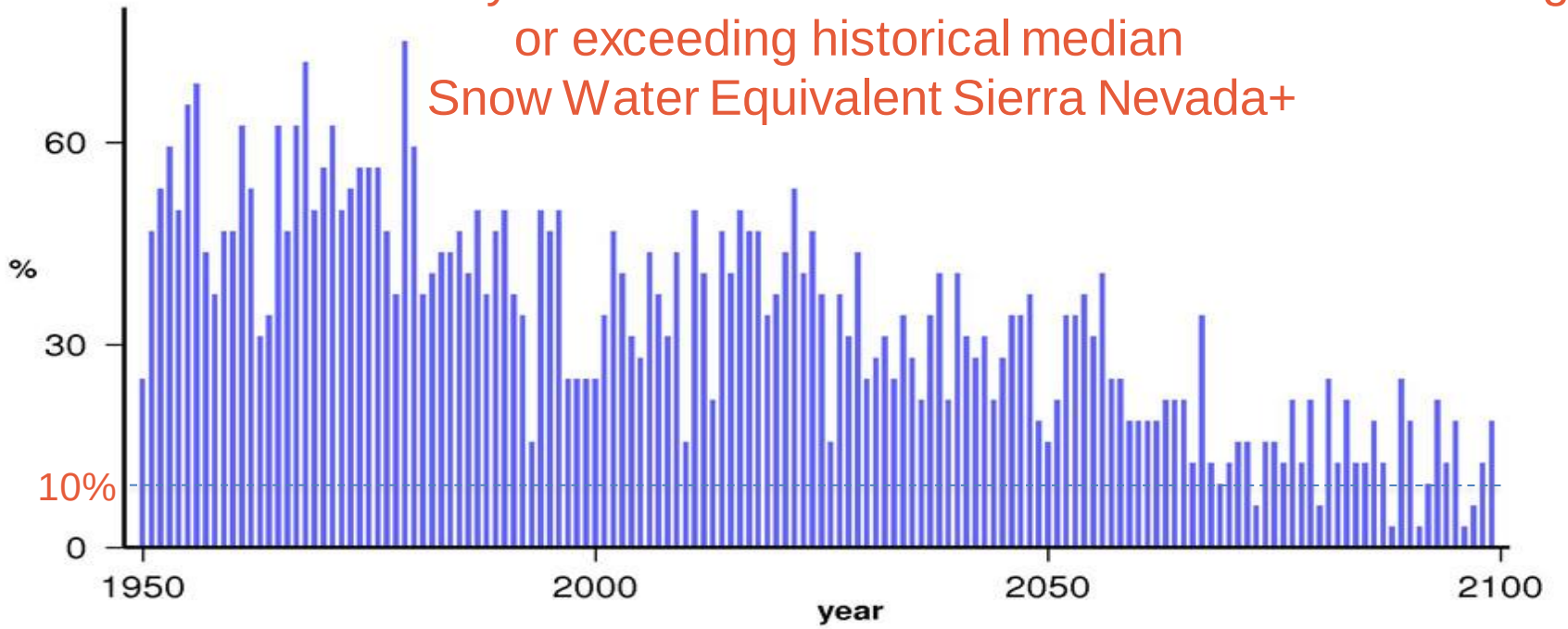
…besides effect on snow, warming will likely increase warm season water demands by humans and ecosystems.

California April 1 SWE from climate simulations

Odds a year is above the average historical median (11.86cm; 1961–1990)

32 BCSD (16 SRESA2 and 16 SRESB1) Median Apr 1 SWE 11.9cm

over 21st Century occurs a marked decline of chances of reaching or exceeding historical median Snow Water Equivalent Sierra Nevada+

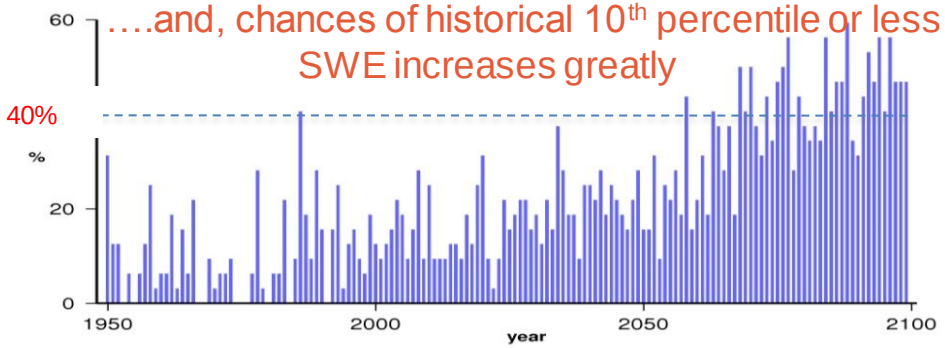


California April 1 SWE from climate simulations

Odds a year is below the historical 10th percentile (3.60cm; 1961–1990)

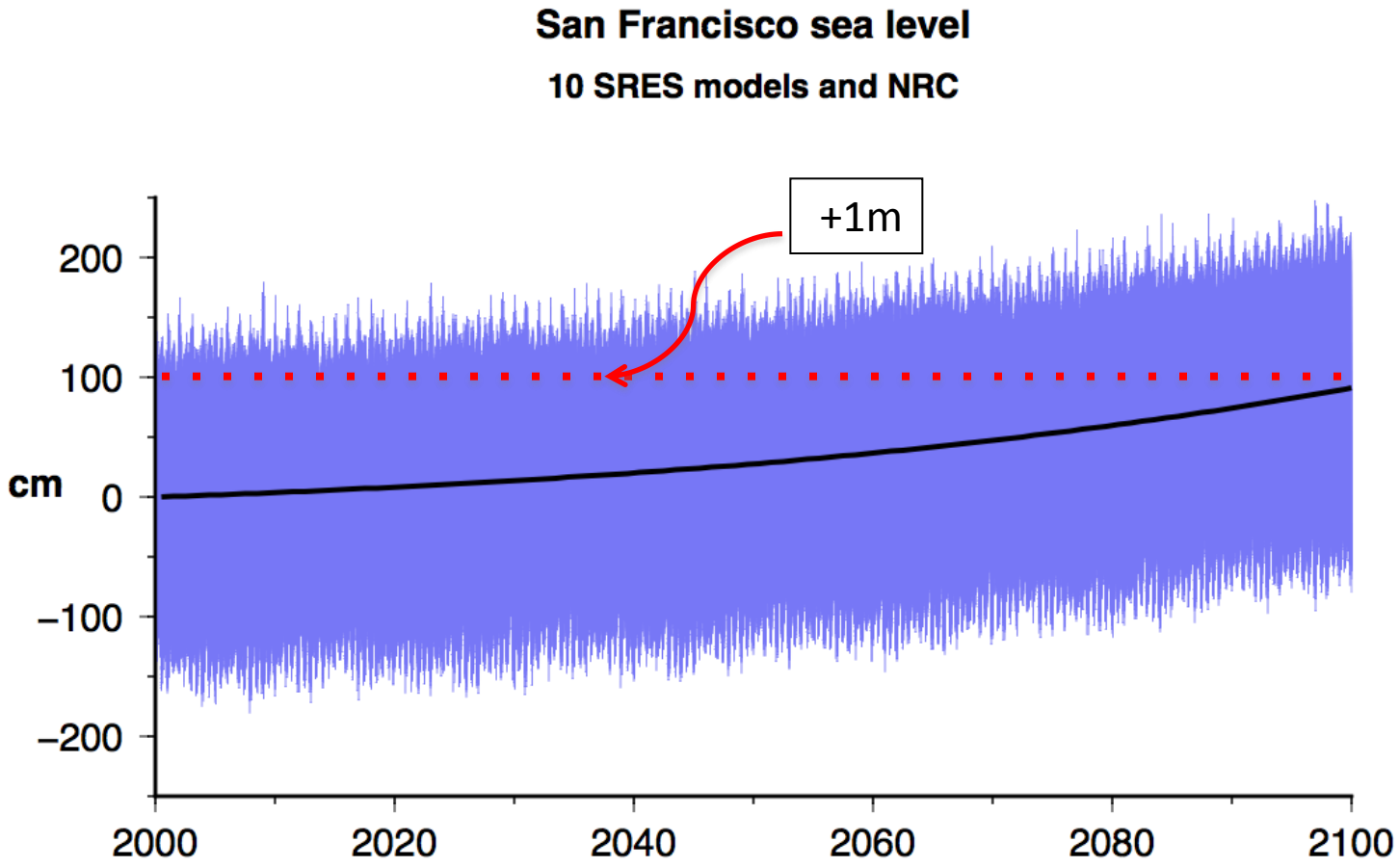
32 BCSD (16 SRESA2 and 16 SRESB1) 10th % Apr 1 SWE 3.6cm

….and, chances of historical 10th percentile or less SWE increases greatly



Multiple factors drive Sea Level Rise and Variability

astronomical tides NRC SLR scenario and 10 RCP4.5. and RCP 8.5 GCMs included within this scenario, could be caluculate probabilistic estimates of sea level exceedance, etc.,
**does not include surface wave s



Summary Points

- A large ensemble of GCMs and associated downscaled simulations (weather, hydrology, ocean conditions) is available to conduct scenario assessments.
- Different sources of uncertainty result in simulations that occupy a range of simulated future levels of variables of interest (T, P, snowpack, sea level, etc)
- Using particular assumptions, the ensemble of simulations over California that may be interrogated to determine “probabilstic” outcomes.
- Evaluations of ensemble variables can be conducted to investigate time averaged and event scale phenomena.